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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to the Manufacture of Pneumatic Tyres

We, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London N.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for assembling and shaping a pneumatic tyre and is an improvement in or modification of the invention described in the complete specification of our cognate Patent applications Nos. 136/59 and 11799/59 (Serial No. 932,792).

In the specification of applications 136/59, 11799/59 (Serial No. 932,792) we have described apparatus for assembling and shaping a pneumatic tyre comprising an inflatable shaping unit, for supporting and shaping a cylindrical tyre carcass, having a pair of bead supporting members and means for moving said members towards and away from one another by equal amounts in relation to the mid-circumferential plane of symmetry of the shaping unit, and a carrying means, said carrying means and shaping unit being relatively movable axially in relation to one another to move a breaker or tread or both secured within the carrying means in the form of a single annulus, into a position in which the breaker or tread or both is symmetrically disposed in relation to a carcass supported by the shaping unit.

According to the present invention, apparatus for assembling and shaping a pneumatic tyre comprises an inflatable shaping unit, for supporting and shaping a cylindrical tyre carcass, having a pair of bead supporting members and means for moving said members towards and away from one another by equal amounts in relation to the mid-circumferential plane of symmetry of the shaping unit, and a carrying means, said carrying means comprising a rigid cylindrical annulus, a plurality of spring fingers disposed in spaced relationship around the inner periphery of the annulus

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and an inflatable member located between at least a portion of each of the fingers and the annulus, said member being inflatable to move the fingers inwardly to grip a tread or a breaker or both, and said carrying means and shaping unit being movable axially in relation to one another to move a breaker or tread or both secured within the carrying means in the form of a single annulus into a position in which the breaker or tread or both is symmetrically disposed around a carcass supported by the shaping unit.

Preferably a collapsible drum is provided for supporting a tread or breaker or both and the carrying means is movable between a position in which it coaxially surrounds and is symmetrically disposed relative to a breaker or tread or both supported on the collapsible drum and a position in which it coaxially surrounds and is symmetrically positioned in relation to a carcass supported by the shaping unit.

Each of the spring fingers of the shaping unit may comprise at least one arm portion which extends in a radial outward and circumferential direction to secure its associated spring finger to the cylindrical annulus. However, the spring fingers may be formed integrally in groups, at least one group being secured at each end of the cylindrical annulus, and each spring finger of the group or groups secured at each end of the cylindrical annulus being disposed between adjacent spring fingers of the group or groups secured at the other end of the annulus.

One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a cross-sectional view on the line I—I of Figure 2 of part of an apparatus according to the invention;

Figure 2 is a section on line II—II of the apparatus shown in Figure 1;

Figure 3 is an axial cross-sectional view

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showing another part of the apparatus.

Figure 4 is an axial view of part of the apparatus shown in Figures 1 and 2;

Figure 5 is an isometric view of part of a carrying means illustrated in Figures 1, 2 and 3.

Figure 6 is a scrap axial cross-sectional view of a modification of part of the above apparatus;

Figure 7 is a scrap axial cross-sectional view of a further modification of the apparatus;

Figure 8 is an axial view of the carrying means shown in Figure 7;

Figure 9 is a scrap view in a radially inward direction of part of the carrying means shown in Figure 8;

As shown in Figures 1 and 2 a tyre building apparatus comprises a collapsible rotatable drum 5, the hub of which is secured to a horizontal shaft 3 rotatably mounted at one end in bearings 2 contained within a bore 2a provided in a machine frame 1. The drum 5 is similar in construction to the collapsible drum described in the specification of our cognate British patent applications 136/59 and 11799/59 (Serial No. 932,792), comprising a cylindrical body portion 5a, a pair of side plates 15 secured one to each end of the body portion 5a to locate axially an inflatable annular bag 6 surrounded by a plurality of arcuately-shaped segments 14 which form a substantially continuous surface in the deflated state of the bag, and a thick rubber annulus 16. The bag is connected to a source of compressed air for inflating the bag or to a source of reduced pressure for deflating the bag, by pipes 7 and 8 connected to a passage-way 9 which is connected to a tube 11 by an annular groove 10 provided in the machine frame. A valve 12 located on the tube is operated to inflate or deflate the bag.

Detachable means for supporting the inner peripheral surface of a tread or breaker is provided upon the collapsible drum. This means comprises a rigid cylindrical metal band 18 which, as shown in Figure 1, is received in an annular recess 17 provided in the annulus 16 when the bag 6 is in an inflated state. As shown in Figure 4, the band 18 has a radially extending split at one part of its circumference and a notch 20 provided on its outer peripheral surface for a purpose to be later described.

A carrying means 23 for removing a tread or breaker or both from the drum 5 and for positioning the tread or breaker or both upon a carcass as will later be described, comprises a rigid cylindrical annulus 23a disposed around the inner peripheral surface of which is an inflatable cylindrical diaphragm 25. The diaphragm is inflatable through a valve 26 extending through an opening 27 in the annulus 23a (see Figure 2). A plurality of spring fingers 24 are located in spaced-apart relationship within the annulus 23a (see particularly

Figures 2 and 5), the fingers each comprising an arcuately-shaped gripping portion 24a which is disposed on the inner peripheral surface of the diaphragm 25, and two parallel arm portions 24b which are formed integrally with the gripping portion and extend in a radially outwardly and circumferential direction, being secured at their radially outer ends to the annulus 23a. The gripping portions 24a form a segmented annulus within the carrying means, each portion 24a overlapping and being circumferentially slidable relative to its adjacent portions 24a. Two lugs 29 (see Figure 2) and a lug 28 are secured in equally spaced-apart positions to the outer peripheral surface of the annulus 23a, three pins 36 received within the lugs securing the carrying means to a disc 35 forming part of a mounting means 32 for the carrying means. The pins 36 are held within the lugs by permanent magnets 31 which are located between the ends of the pins and end plates 28a and 29a of the lugs. A sleeve 34 is coaxially and integrally formed with the disc 35, the sleeve 34 being slidably mounted upon a shaft 33 secured at one end to a vertical member 32a of the mounting means, the member 32a being rotatably mounted upon a base 32b for pivoting the carrying means between a position in which it is coaxial with the cylindrical drum 5 and a position in which it is coaxial with a shaping unit shortly to be described.

A double-acting pneumatic cylinder and piston 37 operable by a two-way valve 38 and mounted on the upper portion of the vertical member 32a, is connected by the end of the piston rod to the disc 35 for moving the carrying unit axially along the shaft 33. Means is provided for locating the carrying unit symmetrically with respect to the mid-circumferential plane of a tread or breaker or both positioned on the drum 5 or, as will be described, for locating a tread or breaker or both carried by the carrying unit symmetrically with respect to the mid-circumferential plane of a tyre carcass. This means comprises a stop ring 39 for the disc 35, the ring being secured to the shaft 33.

As shown in Figure 3, a shaping unit 40 for shaping a pre-built tyre carcass 60 into a cylindrical shape comprises a pair of coaxial disc-shaped bead supporting members 41 between which extends an inflatable cylindrical diaphragm 45, the diaphragm being fixed by its ends to the members 41 by flanged rings 42. One of the members 41 is provided with a detachable bead-retaining flange 41a to allow for the positioning upon and removal from the shaping unit of a tyre carcass. The diaphragm is inflatable by means of a tube 43 which connects the chamber contained between the members 41 and the diaphragm with a source of fluid pressure. Means are provided for moving the bead supporting members towards and away from one another sym-

metrically with respect to the mid-circumferential plane of the shaping unit. This means comprises a shaft 44 rotatably mounted at one end in a machine frame 46, the shaft having right-hand and a left-hand screw-threaded portions, which are received in complementary screw-threaded nuts 47 coaxially mounted on the members 41. Fluid-tight sealing means 48 is provided on the axially inner end of each of the nuts 47 to prevent the escape of air under pressure during inflation of the diaphragm 45. The shaft 44 is rotatable to effect movement of the members 41 through an endless chain 51 (part of which is shown) and sprocket 52 by means of an electric motor and reduction gearbox (both not shown). One of the members 41 is provided with an axially extending shaft 41b which is slidably received in a hole provided in the frame 46 to prevent rotation of the members 41.

The use of the apparatus will now be described.

A breaker 21 and tread layer 22 are located around the cylindrical drum 5 in the expanded state of the diaphragm 6 as shown in Figure 1. The carrying means 23 is then positioned around the tread and breaker assembly with the diaphragm 25 in the uninflated state. When the carrying means is symmetrically positioned with respect to the mid-circumferential plane of the tread and breaker assembly, i.e. when the disc 35 is in engagement with the ring 39, the diaphragm 25 is inflated. Inflation of the diaphragm causes radially inward movement of the arcuately-shaped gripping portions 24a of the spring fingers to grip the outer peripheral surface of the tread and breaker assembly, this inward movement causing the flexing of the portions 24b of the spring fingers. The diaphragm 6 is then deflated to collapse the drum 5, but the metal band 18 remains in position on the inner peripheral surface of the tread and breaker assembly to support the assembly.

The carrying means is removed axially from the drum 5, by actuation of the pneumatic cylinder and piston 37, and rotated upon the base 32b into a position coaxial with the shaping unit 40 upon which a carcass 60 in its cylindrically built condition has been positioned. The metal band 18 is removed from within the tread and breaker assembly by inserting a suitable tool within the notch 20 to move the notched end radially inwardly and so contract the ring. The carrying means is then moved into a position in which the tread and breaker assembly coaxially surrounds the carcass and is symmetrically positioned relative to the mid-circumferential plane of the carcass. Inflation of the diaphragm 45 then takes place simultaneously with rotation of the shaft 44 to draw the bead supporting members towards each other to form the carcass 60 into a toroidal shape and bring the

carcass into engagement with the tread and breaker assembly.

The diaphragm 25 is deflated allowing the portions 24b of the spring fingers to return to their unflexed positions and to allow the carrying means to be removed. The tyre may then be completed in a normal manner.

In a modification (see Figure 6) to the apparatus described above, a carrying means 53 is of similar construction to the carrying means 23, but in this case the arcuately-shaped gripping portions 24a of the spring fingers are also arcuately-shaped in axial cross-section for gripping a partially formed tread and breaker assembly mounted on the cylindrical drum. To partially form the tread and breaker assembly, the annulus 16 of the drum 5 is of convex curvature in an axial direction upon its outer peripheral surface.

In a further modification shown in Figures 7, 8 and 9 a carrying means 54 comprises a rigid annulus 55 contained within which is an inflatable cylindrical diaphragm 56. Two annular springs 57 are secured, each by one end, to the ends of the annulus 55, each spring comprising at its other end a plurality of spaced-apart arcuately-shaped spring fingers 58, the fingers 58 of each spring being positioned between adjacent fingers of the other spring and in engagement with the inner peripheral surface of the diaphragm 56. All the spring fingers 58 form an annulus within the carrying means, and each spring finger is secured at one end in cantilever fashion to the annulus. Each spring finger comprises at its free end a radially inwardly extending gripping flange 59. In use of the carrying means 54, the diaphragm is inflated which causes the free ends of the spring fingers 58 to move radially inwardly thus flexing the fingers. During this inward movement, the flanges 59 grip the outer peripheral surface of a tread and breaker assembly to be removed from the cylindrical drum. To remove the tread and breaker assembly from the carrying means the diaphragm is deflated allowing the spring fingers to return to their unflexed conditions so that the grip of the flanges 59 upon the assembly is released.

WHAT WE CLAIM IS:—

1. Apparatus for assembling and shaping a pneumatic tyre comprising an inflatable shaping unit, for supporting and shaping a cylindrical tyre carcass having a pair of bead supporting members and means for moving said members towards and away from one another symmetrically in relation to the mid-circumferential plane of the shaping unit, and a carrying means, said carrying means comprising a rigid cylindrical annulus, a plurality of spring fingers disposed in spaced relationship around the inner periphery of the annulus and an inflatable member located between at least a portion of each of the fingers and the annulus, said member being inflatable to move

the fingers inwardly to grip a tread or a breaker or both, and said carrying means and shaping unit being movable axially in relation to one another to move a breaker or tread or both secured within the carrying means in the form of a single annulus, into a position in which the breaker or tread or both is symmetrically disposed around a carcass supported by the shaping unit.

2. Apparatus according to claim 1 wherein a collapsible drum is provided for supporting a breaker or a tread or both, said carrying means being movable between a position in which it coaxially surrounds and is symmetrically disposed relative to a breaker or a tread or both supported upon the collapsible drum and a position in which it coaxially surrounds and is symmetrically positioned in relation to a carcass supported by the shaping unit, means being provided for either locating the carrying means relative to the mid-circumferential plane of a breaker or tread or both positioned on the drum or alternatively for locating a tread or breaker or both carried in the carrying means symmetrically with respect to the mid-circumferential plane of a tyre carcass.

3. Apparatus according to either of the preceding claims wherein each of the spring fingers comprises at least one arm portion which is secured at one end to the rigid cylindrical annulus and is provided at its other end with an arcuately-shaped portion, the inflatable member being disposed between the arcuately-shaped portions of the spring fingers and the cylindrical annulus.

4. Apparatus according to either of claims 1 and 2 wherein the spring fingers are formed integrally in groups, at least one group being secured to each end of the cylindrical annulus and each spring finger of the group or groups secured at each end of the cylindrical annulus being disposed between adjacent spring fingers of the group or groups secured at the other end of the annulus.

5. Apparatus according to claim 4 wherein

each spring finger is provided at its end remote from its end secured to the cylindrical annulus with a radially inwardly extending flange portion for gripping a tread or breaker or both located within the carrying means.

6. Apparatus according to either claim 2 or any one of claims 3 to 5 when appendant to claim 2 wherein the collapsible drum comprises detachable means for supporting the inner peripheral surface of a tread or breaker or both after removal of the tread or breaker or both from the collapsible drum.

7. Apparatus according to claim 6 wherein the detachable means comprises a rigid cylindrical band which is detachably mounted in an annular recess provided in the outer peripheral surface of the collapsible drum.

8. Apparatus according to any of claims 2 to 6 wherein the carrying means is axially movable upon a mounting means which is pivotally mounted about an axis parallel to the axis of the carrying means for pivoting the carrying means between a position in which it is coaxial with the cylindrical drum and a position in which it is coaxial with the shaping unit.

9. Apparatus for assembling and shaping a pneumatic tyre constructed and arranged substantially as described herein and shown in Figures 1 to 5 of the accompanying drawings.

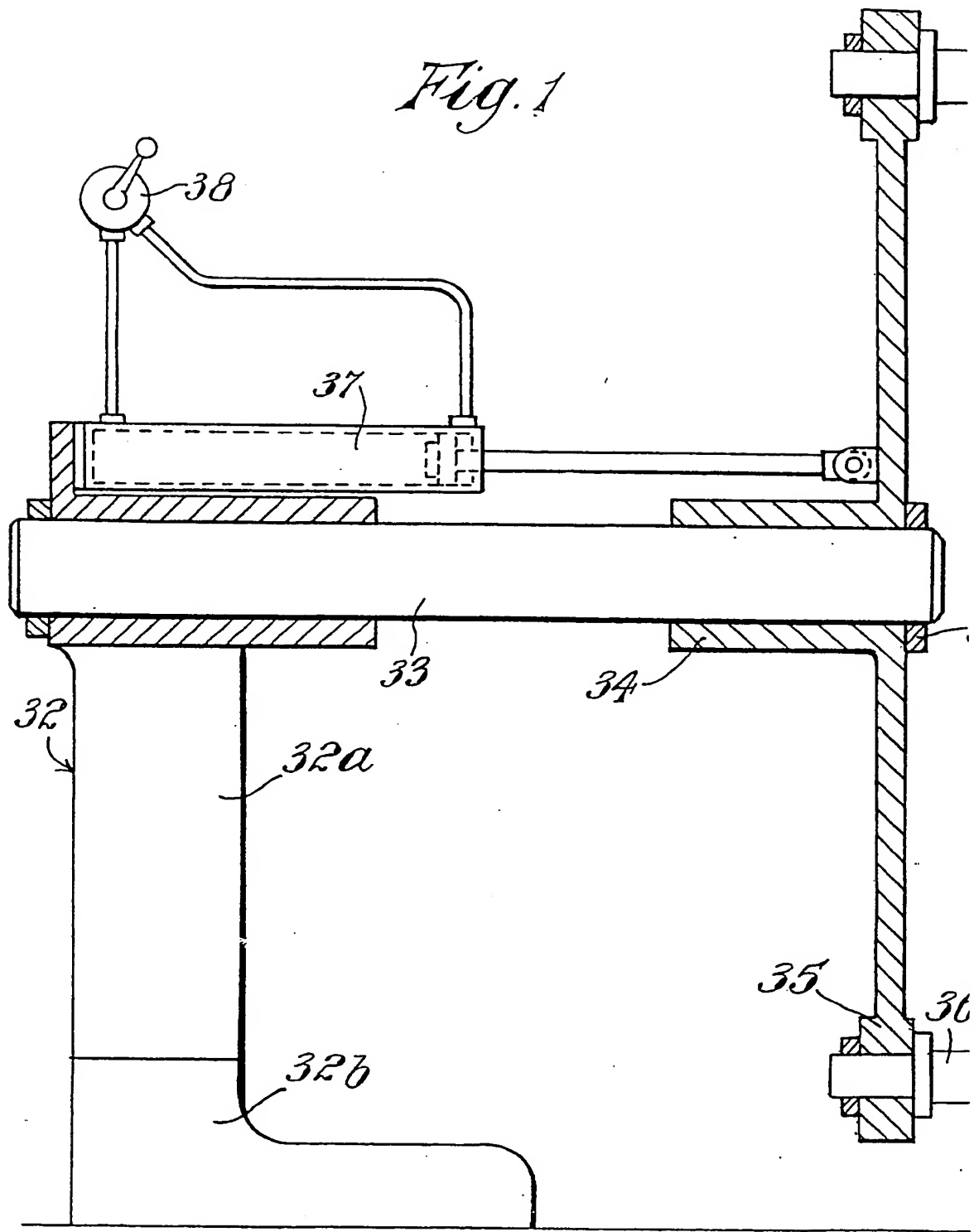
10. Apparatus for assembling and shaping a pneumatic tyre constructed and arranged substantially as described herein and shown in Figures 1 to 5 of the accompanying drawings with the modification shown in Figure 6 of the accompanying drawings.

11. Apparatus for assembling and shaping a pneumatic tyre constructed and arranged substantially as described herein and shown in Figures 1 to 5 of the accompanying drawings with the modification shown in Figures 7, 8 and 9 of the accompanying drawings.

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Agent for the Applicants.

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Fig. 1

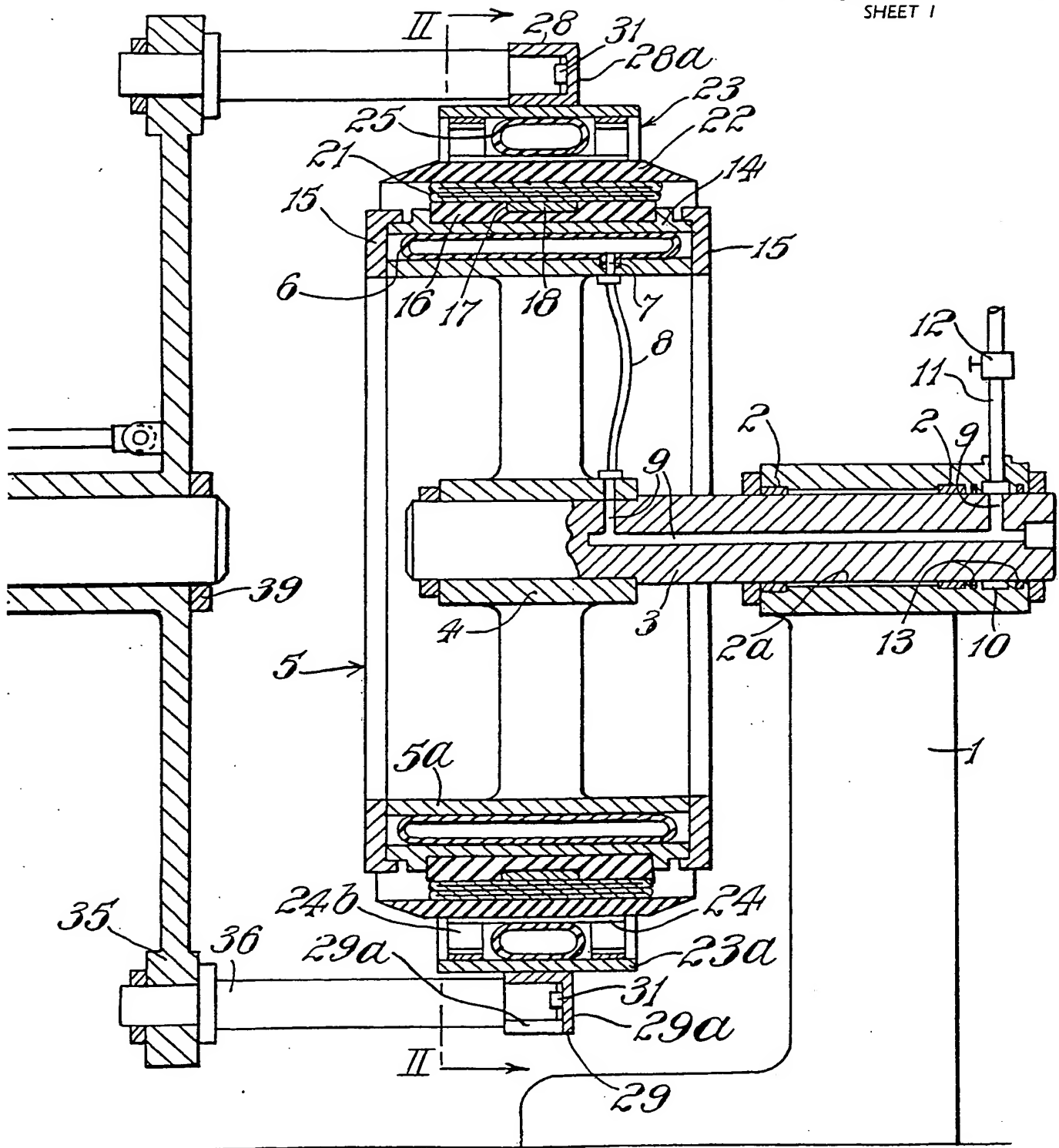


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SHEET 1





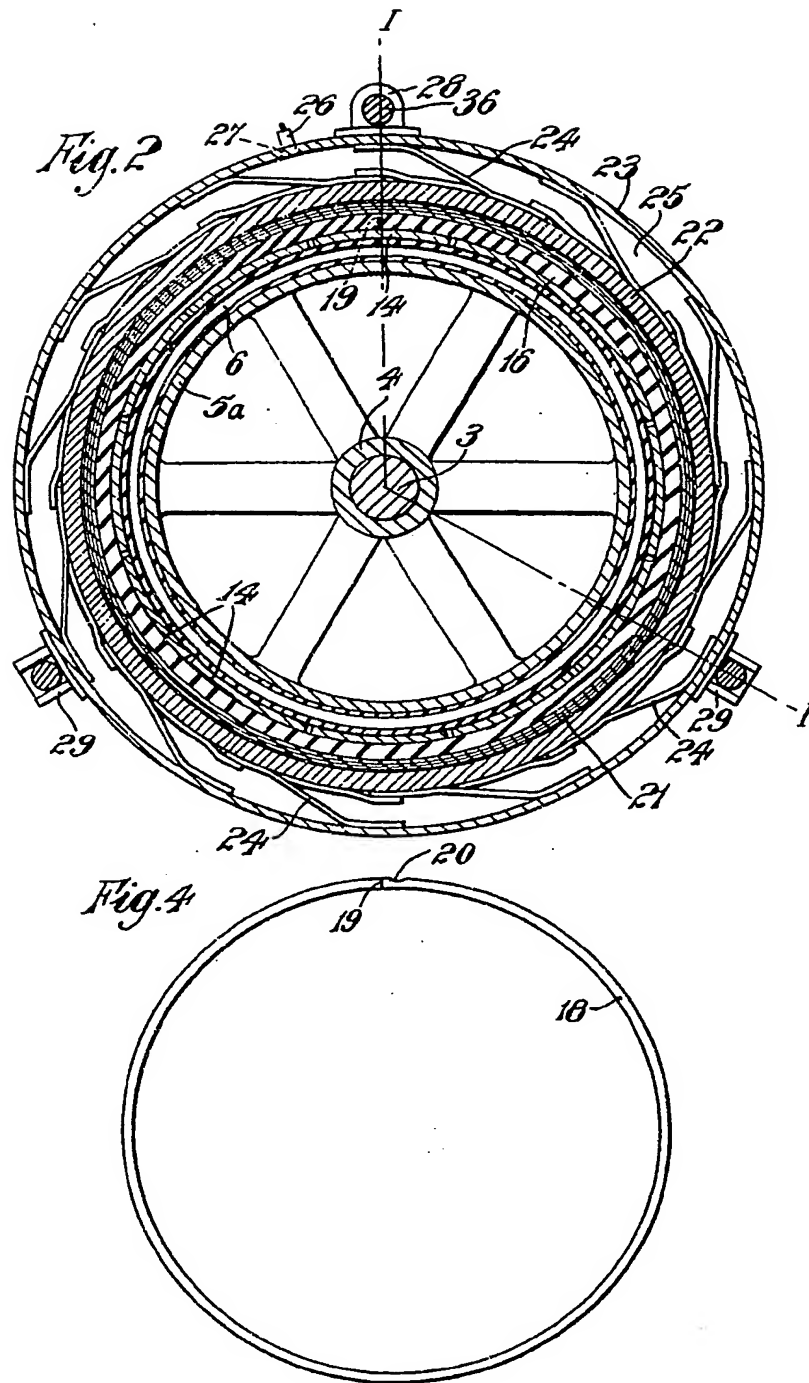
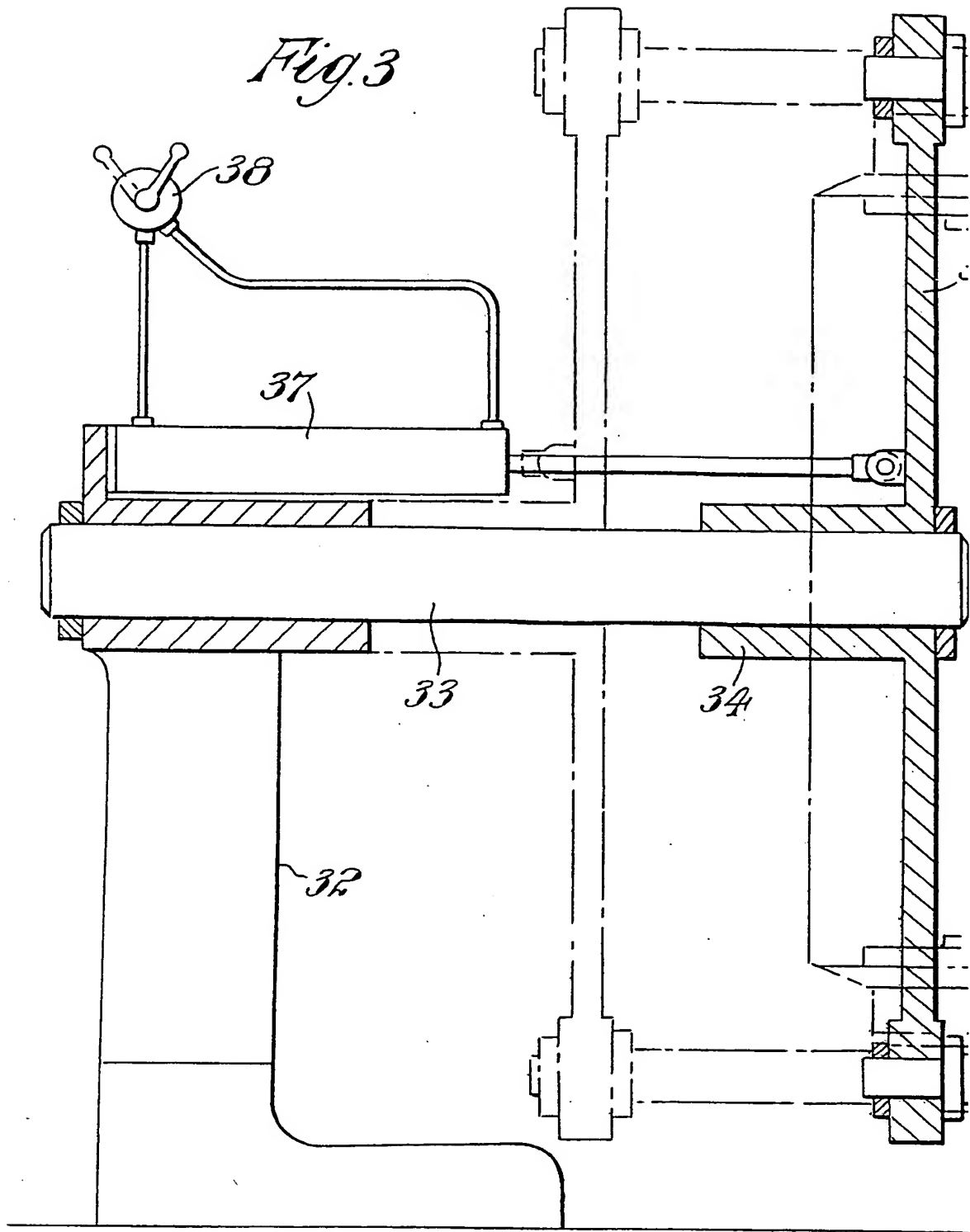
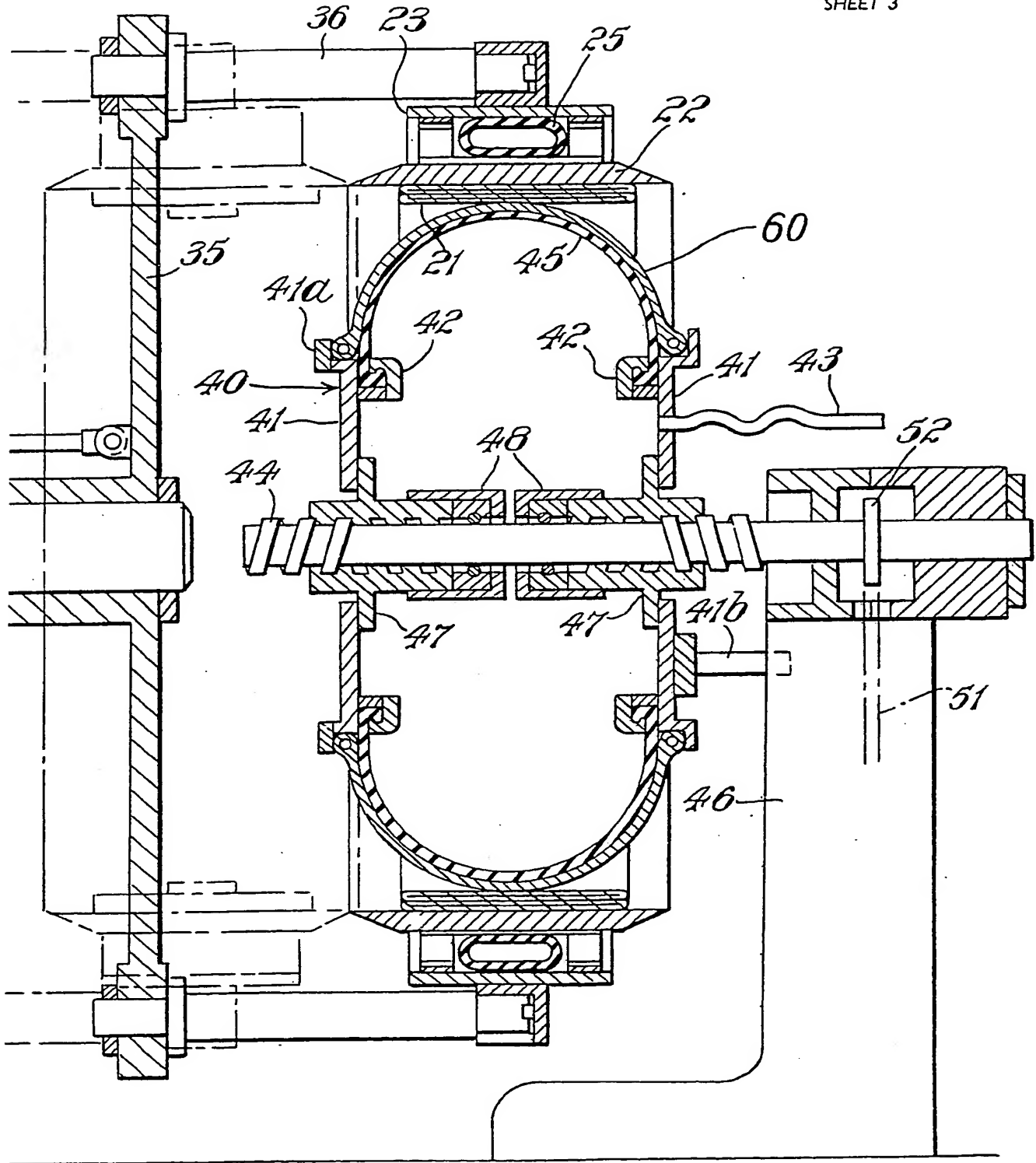
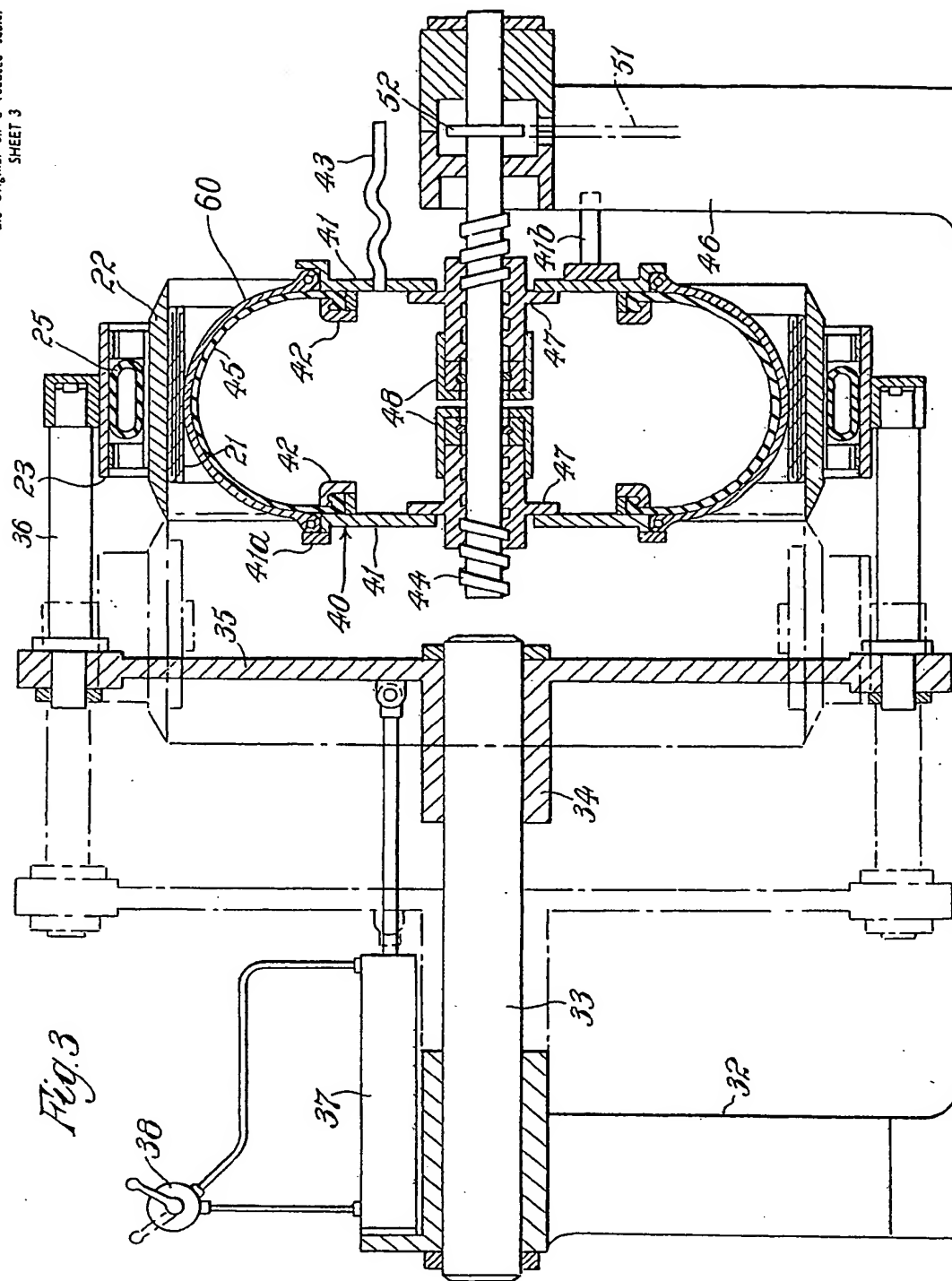
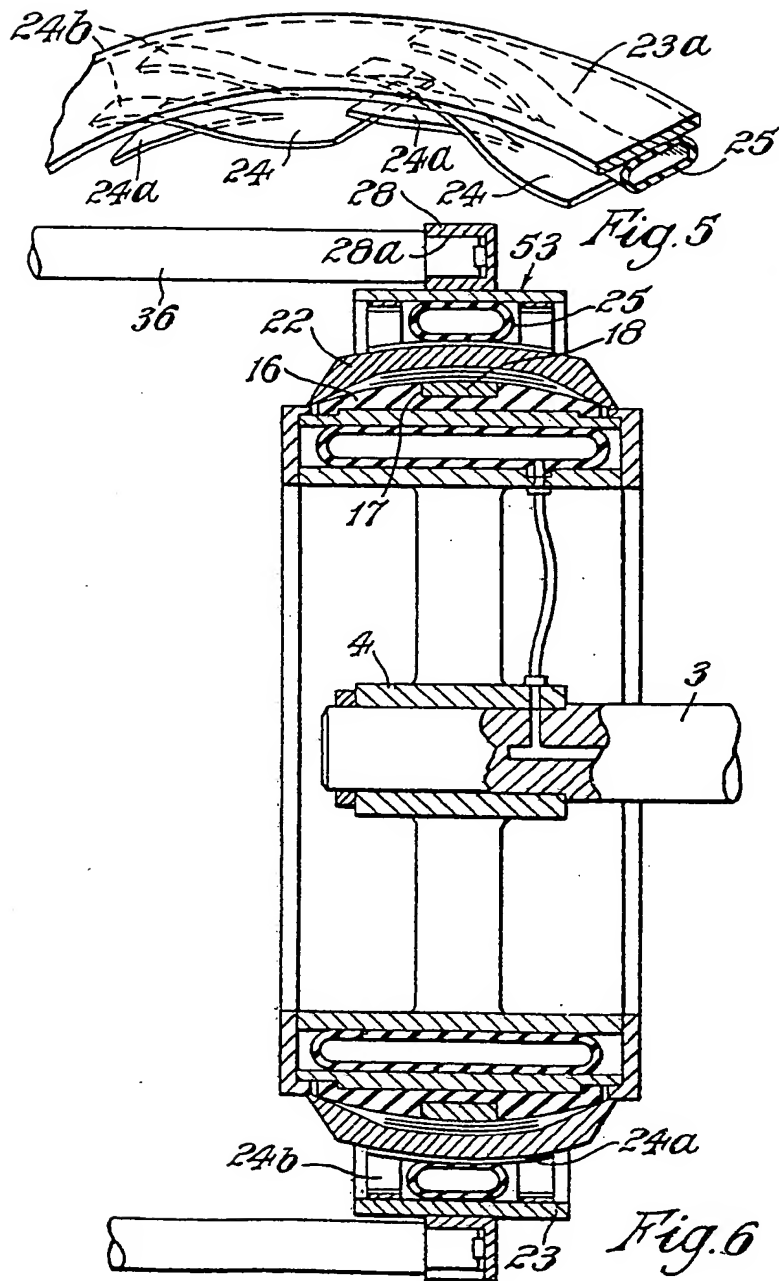


Fig. 3









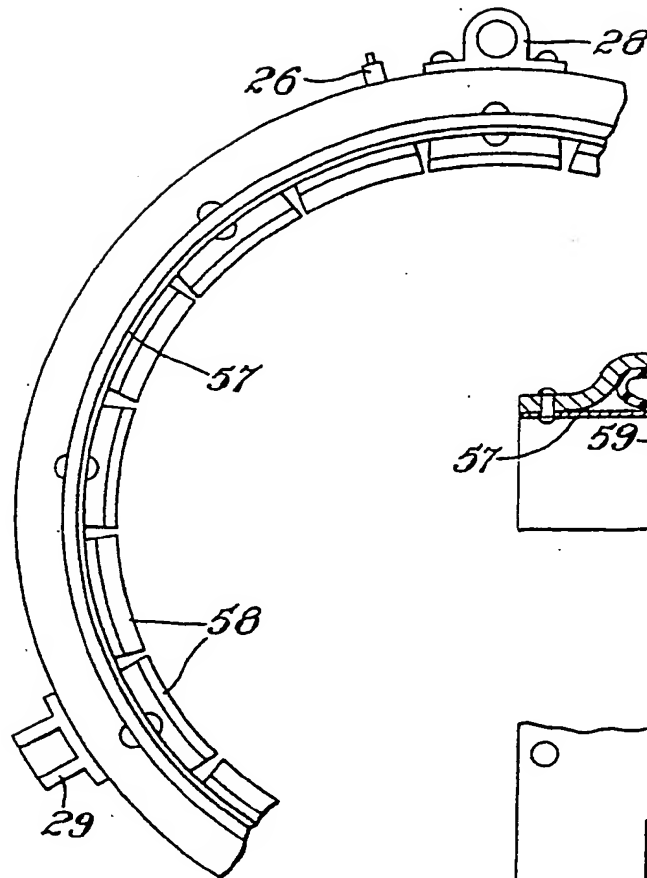


Fig. 8

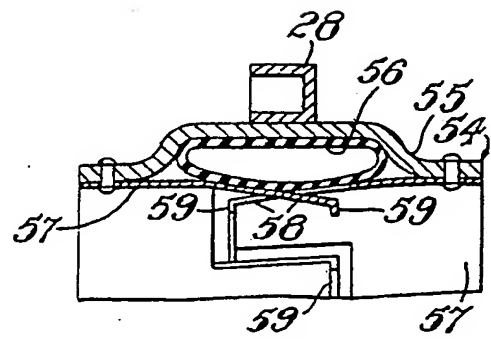


Fig. 7

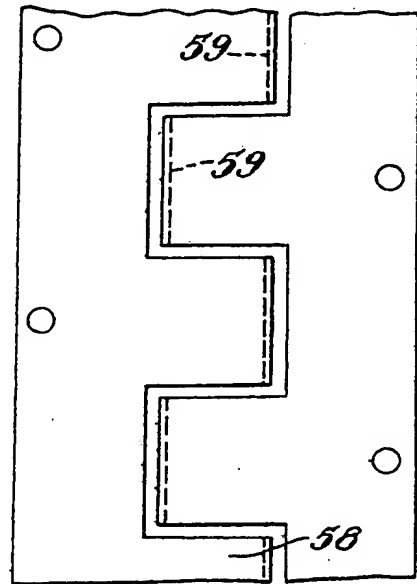
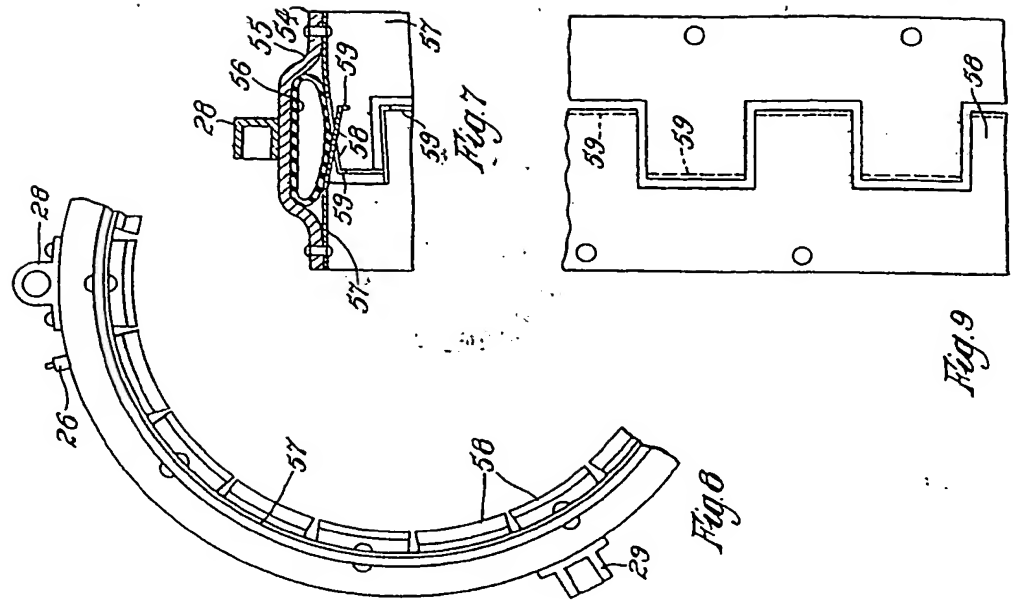
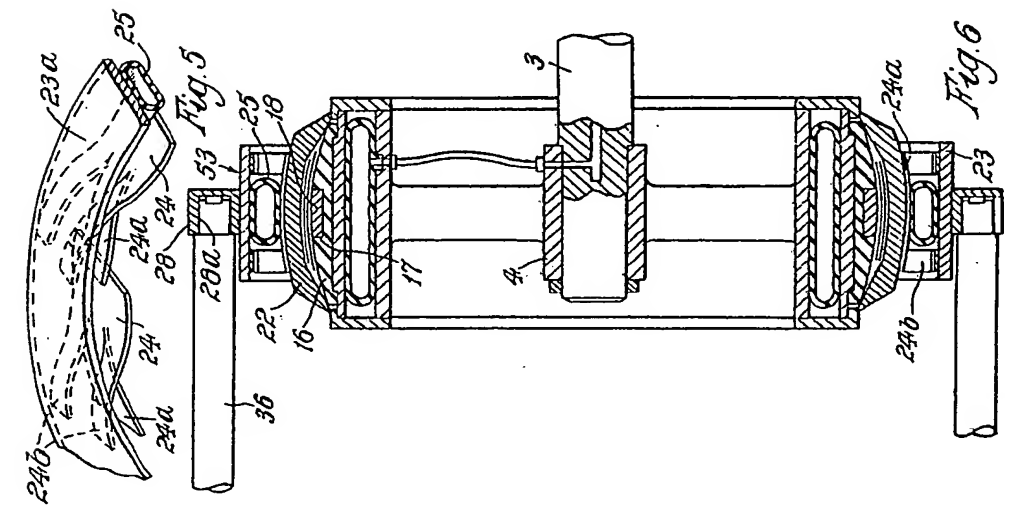


Fig. 9



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